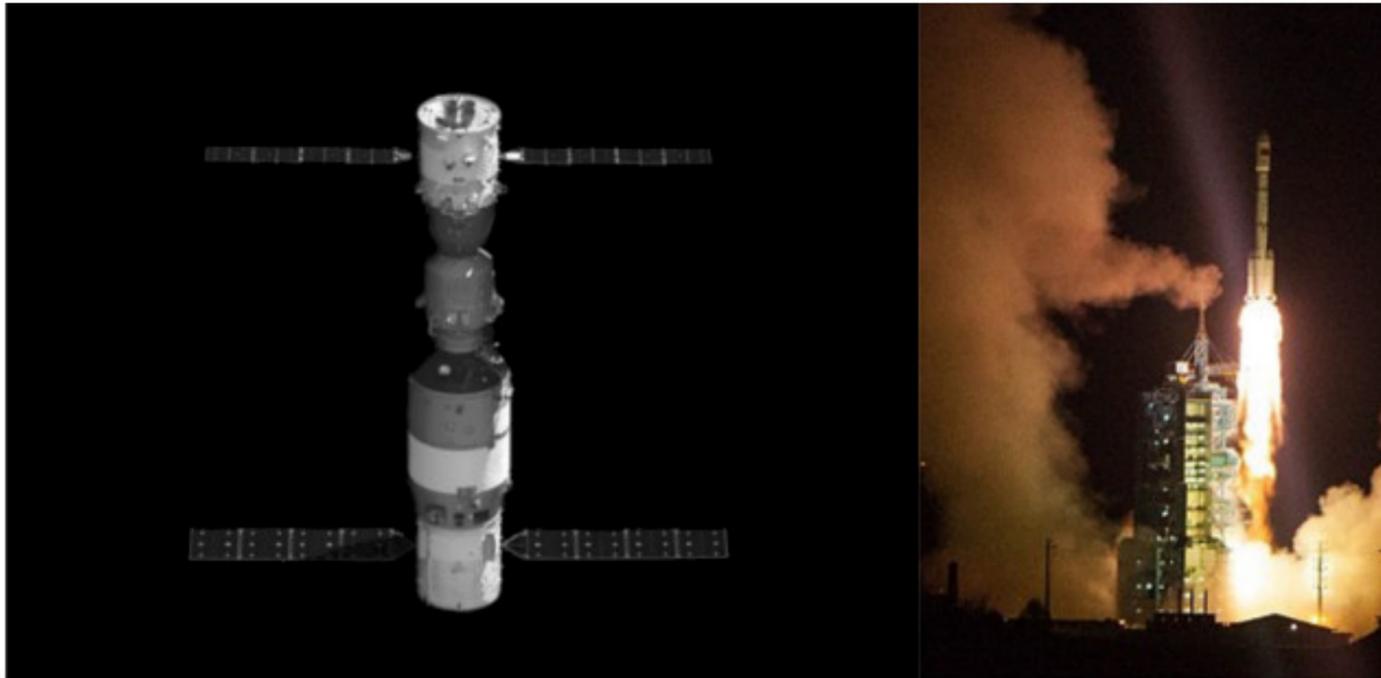


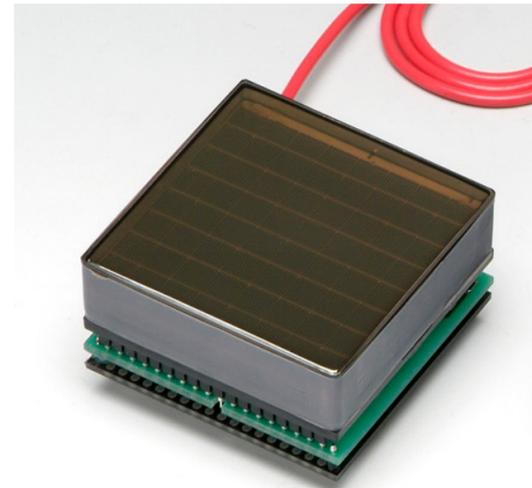
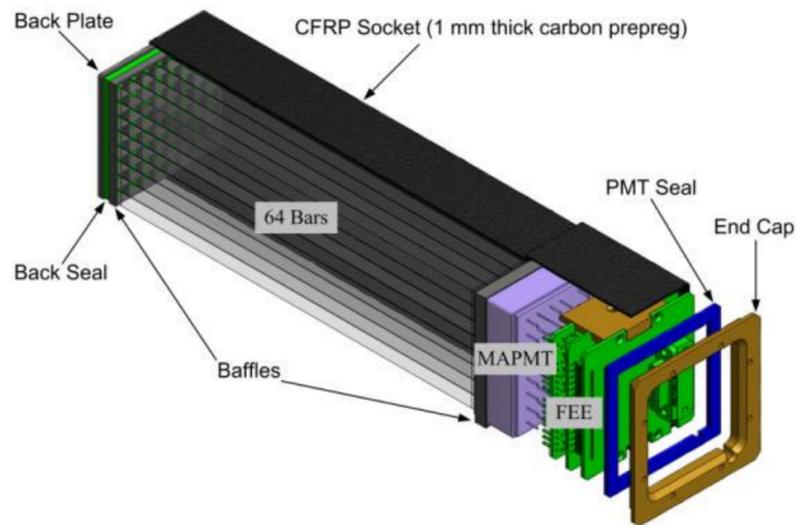
# POLAR a GRB polarimeter



Credit: South China Morning Post



# POLAR design

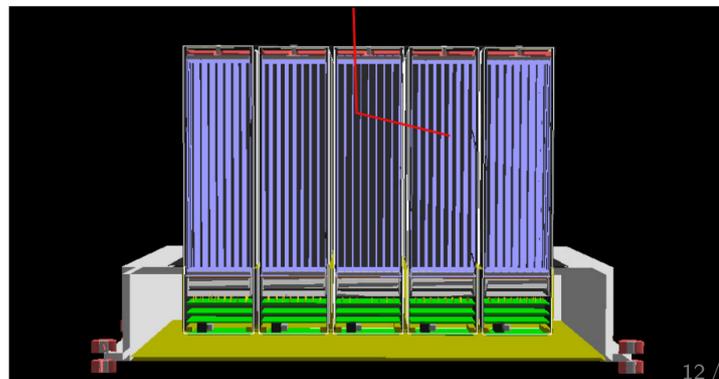
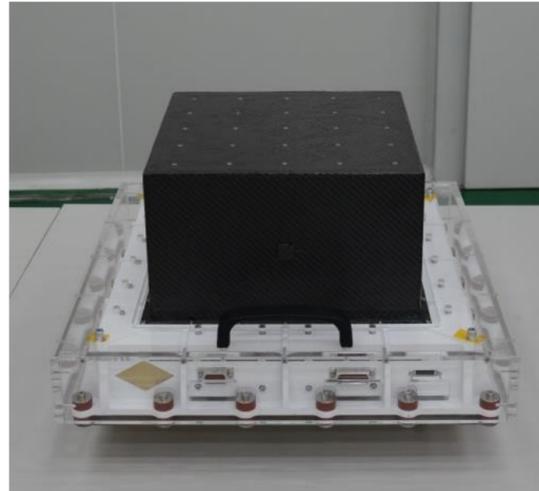


from: [www.hamamatsu.com](http://www.hamamatsu.com)

- Each group of 64 scintillators is read-out using a single MAPMT
- MAPMT is H8500 from Hamamatsu
- Allows for the read-out many channels with a sufficient gain to measure low energy depositions
- Optical cross-talk to neighbouring channels is an issue but can be fixed in analysis
- Cross talk reduced by shaping of scintillators

# Flight model

- Relatively large effective area
- Small pixels allows for high precision scattering angle measurements
- Uniform effective area gives us a large Field of View
- We see half of the sky and perform polarimetry for sources within 1/3rd of the sky
- Full description of the instrument recently published: N. Produit et al. arXiv:1709.07191



# Tiangong 2 mission

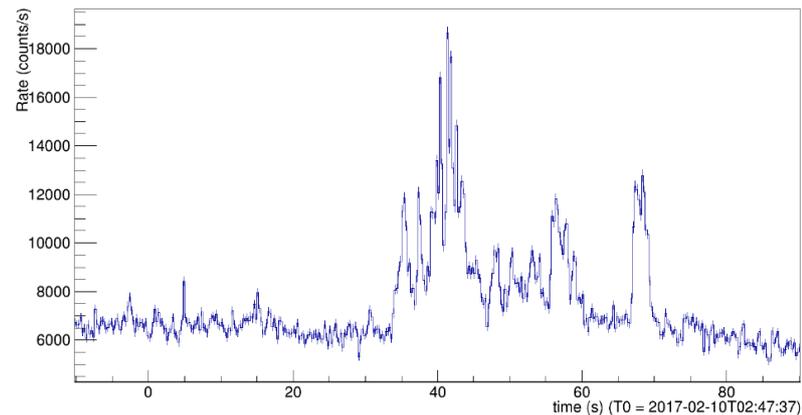


- TG-2 Chinese Space Lab launched on September 15th 2016

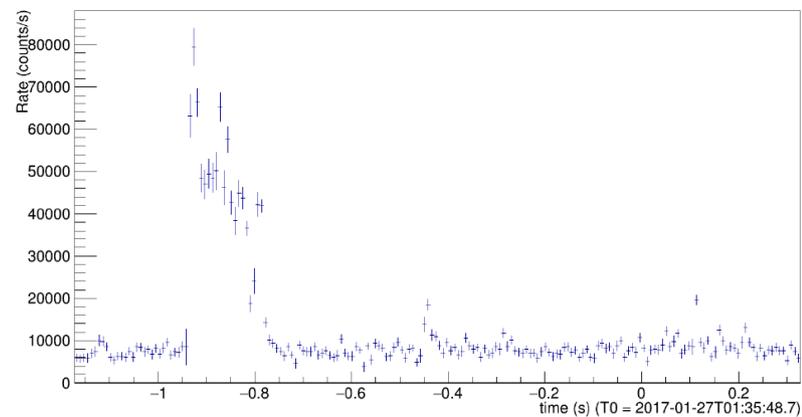
# GRB

- Total of 49 GRBs reported to community
- Light curves on: <http://www.isdc.unige.ch/polar/lc/>
- Approx. 10 of these GRBs have an MDP below 30%

POLAR-GRB 170210A (250 ms bins)

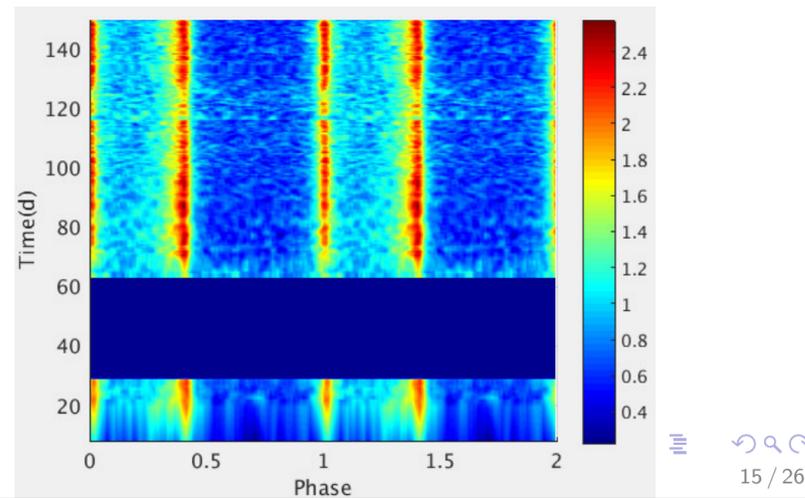
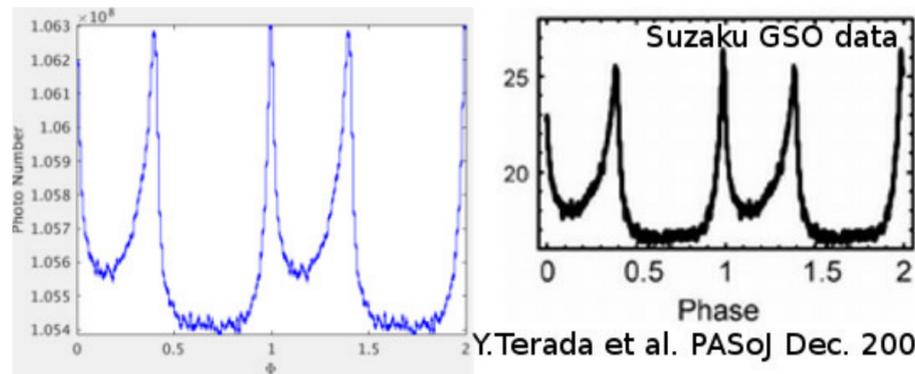


POLAR-GRB 170127C (7.8125 ms bins)



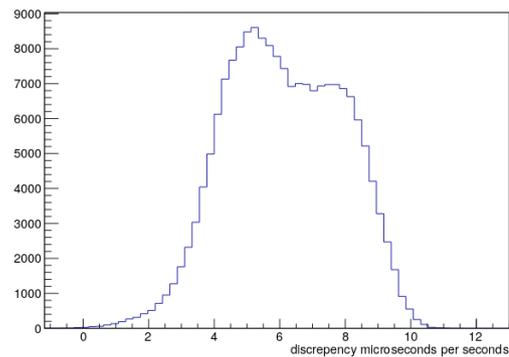
# Crab

- Crab illustrates our timing capabilities
- Timing shown precision shown to be below 1 ms
- Crab can serve as energy calibration source
- and potential polarisation measurement target

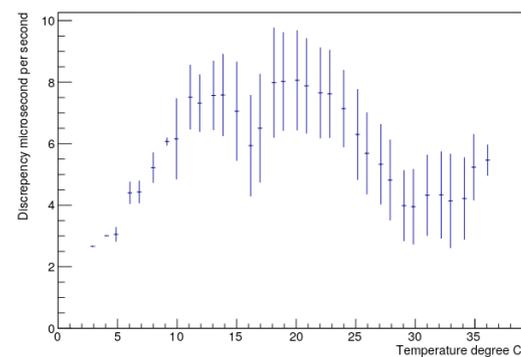


# Absolute clock timing

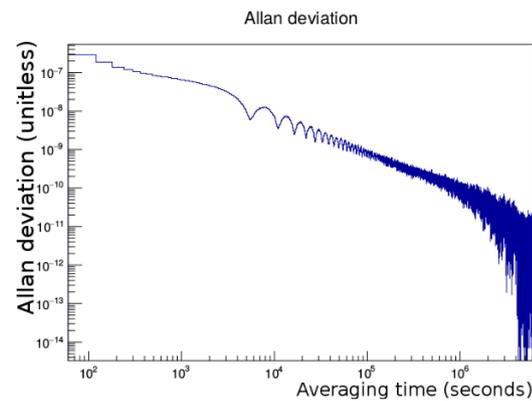
Quartz clock 12.5 MHz disciplined with GPS every 60 seconds  
90 minutes orbit visible



(a) Synchronization

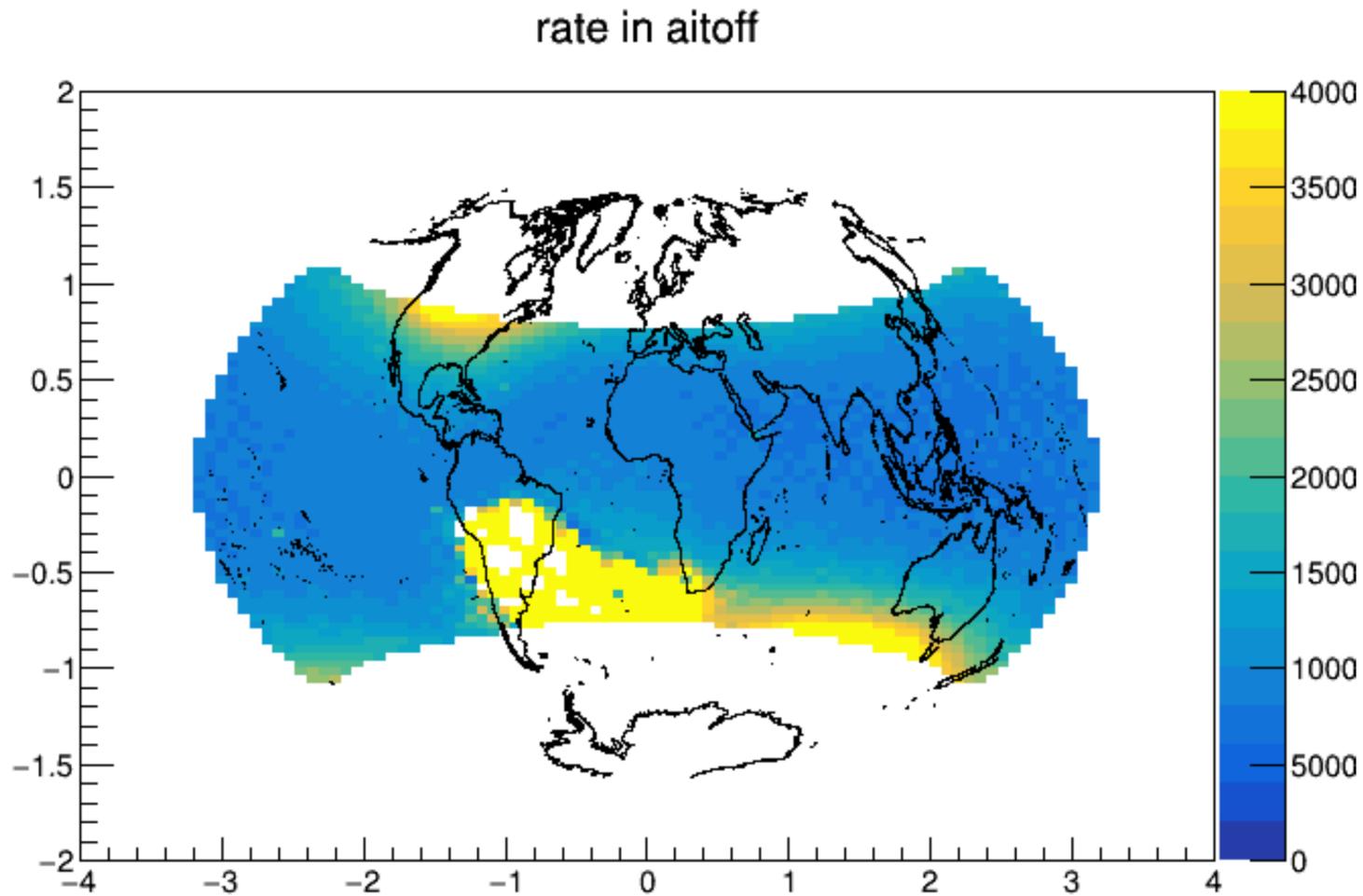


(b) Synchronization versus temperature



(c) Allan deviation

# Background



# POLAR-2: The first large scale Gamma-Ray Burst polarimeter

- POLAR-2 design is based on that of the successful POLAR detector

- POLAR produced the first catalog of polarization measurements, results currently under review

- Results indicate more detailed measurements are required

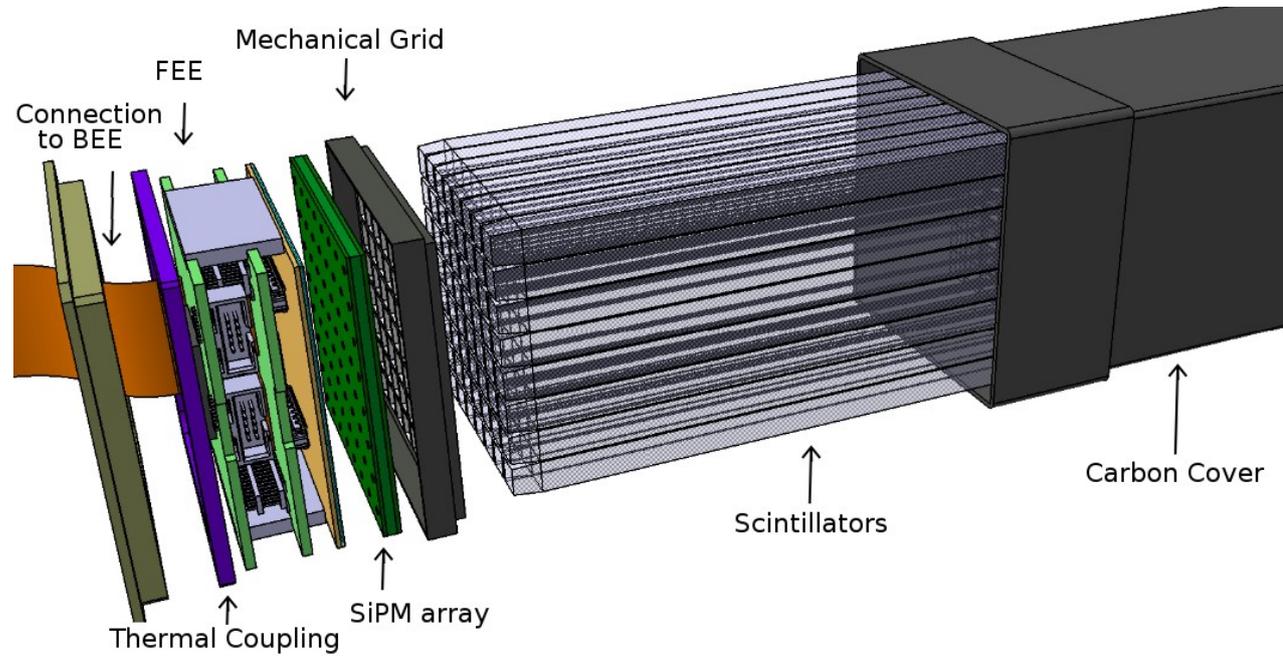
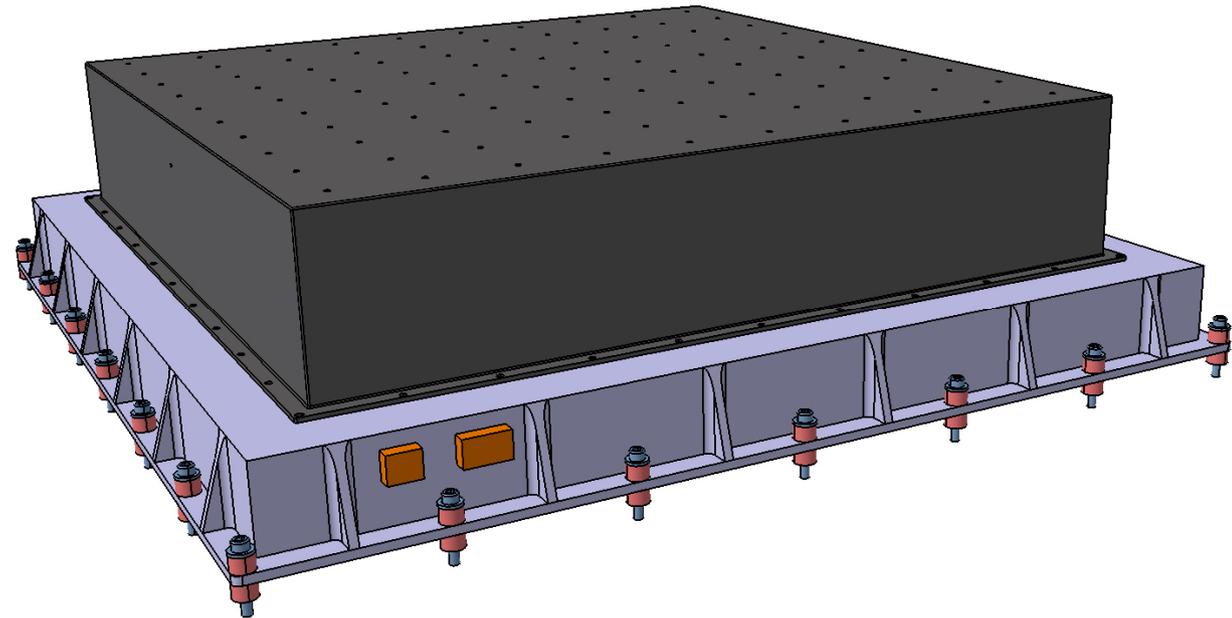
- POLAR-2 will consist of 6400 plastic scintillator bars

- Scintillators are read out in groups of 64 by SiPM arrays, significant improvement over PMTs used in POLAR

- Each SiPM array has its own FEE with one ASIC and FPGA

- 800x800x200 mm

- 80 kg



# POLAR-2

- Design remains largely based on that of POLAR to allow for fast production and low costs

- Increase in size of a factor 4 compared to POLAR and use of SiPM arrays increases sensitivity significantly

- POLAR-2 will be more sensitive than Fermi-GBM

- Will detect even the weakest GRBs, making it also useful for gravitational wave counter part searchers

- Detection of ~150 GRBs per year

- Detailed polarization measurements 30 GRBs per year

- Time resolved polarization measurements for 10 GRBs per year

- Launch ~2024, operation foreseen to be 2 years

